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ART UNIT	**PAPER NUMBER**
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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/838,449	AXELROD ET AL.	
	Examiner	Art Unit	
	Mary C Hogan	2123	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *29 August 2001*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-60* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-60* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *19 April 2001* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☒ Other: RULE 105 REQUIREMENT

DETAILED ACTION

1. This application has been examined.

2. **Claims 1-60** have been examined.

Information Disclosure Statement

3. Applicant cites various documents in the specification, specifically on pages 2,15,21,35-37,46,47 and 53. It is unclear as to why an information disclosure statement was not filed with the application. Applicant is reminded of the duty to disclose all information pertinent to the patentability and examination of the application under 37 C.F.R. 1.56.

Specification

4. The disclosure is objected to because of the following informalities. Appropriate correction is required.

5. **Page 6, line 10**: there are two periods after the word "discussed".

6. **Page 14, line 1**: the word "disclosure" is misspelled.

7. **Page 15, line 3**: a space is needed between "x" and "admits".

8. **Page 60, line 10 and Page 65, line 22**: element 1000 is referred to as the probability flow matrix of Figure 9; however, it does not appear in the figure. Element 1000 also is referenced in Figure 10 wherein it is disclosed that this element is the system to perform the invention. It is unclear as to what element 1000 is referring to.

9. **Page 60, line 12**: column 1030 should read column 930.

Drawings

10. The drawings are objected to because **Figure 8, element 420** should be element 820. Corrected drawing sheets are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. The replacement sheet(s) should be labeled "Replacement Sheet" in the page

header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claims not Rejected with Prior Art

11. **Claims 26-28, 30-34** have not been rejected under prior art at this time.

Claim Rejections - 35 USC § 112

12. **The following is a quotation of the second paragraph of 35 U.S.C. 112:**
The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

13. **Claims 24,52, and 57** rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

14. **Claims 24,52, and 57** recite the limitation "determining a metric" wherein it is unclear as to what the "metric" refers to. The further limitations of claims 25,29, 53,54,58 and 59 imply that the metric is an acoustic confusability and the synthetic word error rate, however, claims 35 and 41 do not give further insight into what this "metric" is directed to since they only further limit step (a) in the independent claims.

Claim Interpretation

15. **Claims 24,52, and 57** recite the limitation "determining a metric" wherein it is unclear as to what the "metric" refers to. The further limitations of claims 25,29, 53,54,58 and 59 imply that the metric is an acoustic confusability and the synthetic word error rate, however, claims 35 and 41 do not give further insight into what this "metric" is directed to since they only further limit step (a) in the independent claims. The broadest reasonable interpretation of the term "metric" is a measure of acoustic perplexity or synthetic word error rate.

16. **Claims 41 and 46** recite the following limitation "determining acoustic confusability from the edit distance". However, the specification does not show the method as to how the confusability is "determined" from the edit distance. Therefore, it was determined from the explanation in the

specification on edit distance (section 11) that the broadest reasonable interpretation of this term is the distance itself is used as a determination of confusability.

35 USC § 101

17. 35 U.S.C. 101 reads as follows:

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

18. **Claims 1-50** are rejected under 35 U.S.C. 101 because the claimed invention is not supported by an asserted or well established utility and is not tangible.

19. An invention, which is eligible for patenting under 35 U.S.C.101, is in the useful arts when it is a machine, manufacture, process or composition of matter, which produces a concrete, tangible, and useful result. The fundamental test for patent eligibility is thus to determine whether the claimed invention produces a ***useful, concrete and tangible result.*** The test for practical application as applied by the examiner involves the determination of the following factors:

(1) Useful- The Supreme Court in *Diamond v. Diehr* requires that the examiner look at the claimed invention as a whole and compare any asserted utility with the claimed invention to determine whether the asserted utility is accomplished. Applying utility case law the examiner will note that:

(a) the utility need not be expressly recited in the claims, rather it may be inferred.

(b) if the utility is not asserted in the written description, then it must be well established.

(2) Tangible - Applying *In re Warmerdam*, 33 F.3d 1354, 31 USPQ2d 1754 (Fed. Cir. 1994), the examiner will determine whether there is simply a mathematical construct claimed, such as a disembodied data structure and method of making it. If so, the claim involves no more than a manipulation of an abstract idea and therefore, is nonstatutory under 35 U.S.C. 101. In *Warmerdam* the abstract idea of a data structure became capable of producing a useful result when it was fixed in a tangible medium which enabled its functionality to be realized.

(3) Concrete- Another consideration is whether the invention produces a concrete result. Usually, this question arises when a result cannot be assured. An appropriate rejection under 35 U.S.C. 101 should be accompanied by a lack of enablement rejection, because the invention cannot operate as intended without undue experimentation.

20. Furthermore, although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

21. **Claims 1-50** are rejected under 35 U.S.C.101 because they appear to be reciting a mathematical algorithm, therefore nor producing a concrete, useful and tangible result.

Claim Rejections - 35 USC § 102

22. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

23. **Claims 1,15-19,21,23,24,29,35-37,39,52,54,56,57,59** are rejected under 35 U.S.C. 102(b) as being anticipated by Bahl et al (U.S. Patent Number 4,817,156), herein referred to as **Bahl**.

24. As to **Claims 1 and 51, Bahl** teaches: A method comprising the steps of: creating an evaluation model from at least one evaluation phone **(column 12, lines 36-41)**; creating a synthesizer model from at least one synthesizer phone **(column 12, lines 46-51)**; and determining a matrix from the evaluation and synthesizer models **(Figure 13 and description)**, memory **(Figure 4 and description, Figure 8, element 204, Figure 12B, element 414)**, processor **(Figure 1, element 102)**.

25. As to **Claims 15 and 56, Bahl** teaches: a method comprising the steps of: a) creating an evaluation model from a plurality of evaluation phones **(column 12, lines 36-41)**, each of the phones corresponding to a first word **(column 6, line 65-column 7, line 5)**; b) creating a synthesizer model from a plurality of synthesizer phones **(column 12, lines 46-51)**, each of the phones corresponding to a second word **(column 6, line 65-column 7, line 5)**; c) creating a product machine from the evaluation model and synthesizer model, the product machine comprising a plurality of transitions and a plurality of states **(Figure 13, column 4, lines 8-23)**; d) determining a matrix from the product machine **(Figure 13)**; and e) determining acoustic confusability of the first word and the second word by using the matrix **(Figure 13, column 4, lines 11-19)**.

26. As to **Claim 16, Bahl** teaches: wherein each of the evaluation and synthesizer models comprises a hidden Markov model **(column 3, lines 20-24)**.

27. As to **Claim 17, Bahl** teaches: further comprising the step of determining synthetic likelihoods for each of the plurality of product machine states **(column 4, lines 21-22, column 14, lines 61-66)**.

28. As to **Claim 18, Bahl** teaches: wherein each synthetic likelihood is a measure of the acoustic confusability of two specific observation densities associated with the hidden Markov models of the evaluation and synthesizer models **(column 4, lines 21-22, column 14, lines 61-66)**.

29. As to **Claim 19, Bahl** teaches: wherein the synthetic likelihoods are compressed by normalization **(column 13, lines 60-64)**.

30. As to **Claim 21 and 39, Bahl** teaches: the method of claim 17, wherein all synthetic likelihoods are determined through an empirical measure **(column 3, lines 20-28, lines 35-40)**.

31. As to **Claims 23,29,54 and 59, Bahl** teaches: the method of claim 15, further comprising the steps of: f) performing steps (a) through (e) for a plurality of word pairs, each word pair comprising evaluation and synthesizer models, thereby determining a plurality of acoustic confusabilities **(Figure 3 and description, column 8, line 62-column 9, line 6, column 10, lines 23-30)**; and g) determining synthetic acoustic word error rate by using the plurality of acoustic confusabilities **(column 18, lines 60-61)**. The method taught in **Bahl** uses the acoustic confusabilities to provide speech recognition, therefore, the error rate that is determined using this model as discussed, is a measure of a synthetic acoustic error rate since it is based on acoustic data.

32. As to **Claims 24,52 and 57, Bahl** teaches: a method comprising the steps of: a) determining acoustic confusability for each of a plurality of word pairs **(Figure 13, column 4, lines 8-17)**; and b) determining a metric by using the acoustic confusabilities **(column 18, lines 60-61)**. The method taught in **Bahl** uses the acoustic confusabilities to provide speech recognition; therefore, the error rate that is determined using this model as discussed in **Bahl**, is a measure of a synthetic acoustic error rate since it is based on acoustic data. Further, the term "a metric" could encompass various measurements, therefore, the error rate is one possible measurement.

33. As to **Claim 35, Bahl** teaches: wherein each of the words of the word pairs is represented by a hidden Markov model, and wherein step (a) further comprises the steps of: creating a product machine for each of the plurality of word pairs, wherein each word each product machine comprising a plurality of states and a plurality of transitions determined by the hidden Markov models of a corresponding word pair **(Figure 13, column 4, lines 8-23, column 6, line 65-column 7, line5)**; and for each product machine, determining synthetic likelihoods for each of the plurality of product machine states **(column 4, lines 21-22, column 14, lines 61-66)**.

34. As to **Claim 36, Bahl** teaches: wherein each synthetic likelihood is a measure of the acoustic confusability of two specific observation densities associated with the hidden Markov models of the corresponding word pair **(column 4, lines 21-22, column 14, lines 61-66)**.

35. As to **Claim 37, Bahl** teaches: wherein the synthetic likelihoods are compressed by normalization **(column 13, lines 60-64)**.

36. **Claims 46-50,55 and 60** are rejected under 35 U.S.C. 102(b) as being anticipated by Gravier et al (Gravier et al, "Directory Name Retrieval Using HMM Modeling and Robust Lexical Access", Automatic Speech Recognition and Understanding, 1997. Proceedings., 1997 IEEE Workshop on , 14-17 Dec. 1997 Pages:558 – 565), herein referred to as **Gravier**.

37. As to **Claims 46, 55 and 60, Gravier** teaches: a method for determining acoustic confusability of a word pair, the method comprising the steps of: determining an edit distance between each word of the word pair; and determining acoustic confusability from the edit distance **(page 563, paragraph 2, sentence 2, abstract, sentence 4)**.

38. As to **Claim 47, Gravier** teaches: wherein the edit distance is determined by determining a number of operations and a type of each operation to change one word of the word pair into the other word of the word pair **(page 563, paragraph 2, sentence 2**, "determined as the number of...").

39. As to **Claim 48, Gravier** teaches: wherein the operations are selected from the group consisting essentially of deletions, substitutions and additions of phones **(page 563, paragraph 2, sentence 2)**.

40. As to **Claim 49, Gravier** teaches: further comprising the step of weighting each operation **(page 563, paragraph 2, sentence 4)**.

41. As to **Claim 50, Gravier** teaches: further comprising the step of assigning a cost to each operation **(page 563, paragraph 2, sentence 4)**.

Claim Rejections - 35 USC § 103

42. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject

matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

43. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

44. **Claims 2-14** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Bahl** as applied to claim 1 above, and further in view of Stolcke (Stolcke, Andreas, "An Efficient Probabilistic Context-free Parsing Algorithm that Computes Prefix Probabilities", Computational Linguistics, Volume 21, Issue 2, June 1995, pages: 165 – 201), herein referred to as Stolcke.

45. As to **Claims 2,3,7-9**, **Bahl** teaches: wherein the at least one evaluation phone comprises a first plurality of evaluation phones **(column 7, lines 31-40, Figure 4 and description)**, the at least one synthesizer phone comprises a first plurality of synthesizer phones **(column 7, lines 31-40, Figure 4 and description)**; and determining acoustic confusability from one of the specific elements **(column 14, lines 64-67** wherein each element in the matrix is a confusability**)**.

46. **Bahl** does not expressly teach: wherein the method further comprises the steps of: creating a new matrix by subtracting the matrix from an identity matrix; creating an intermediate matrix comprising the new matrix and a second identity matrix; determining a first set of specific elements of the intermediate matrix, determining an inverse of a matrix, performing row and column operations.

47. **Stolcke** teaches a matrix R as a matrix of the sum of probabilities for changes of state between two state machines **(page 178, item d and the last 3 paragraphs)** and an algorithm in which the matrix is created by subtracting a new matrix from an identity matrix; creating an intermediate matrix comprising the new matrix and a second identity matrix; determining a first set of specific elements of the intermediate matrix, determining an inverse of a matrix, performing row and column operations **(pages 197-198, section B.3.1)**. **Stolcke** teaches this as a method to speed up the time it takes to compute the matrix R and perform matrix inversion, thereby reducing computational cost **(page 198, paragraph 4)**.

48. It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the determination of a matrix of acoustic confusabilites (probabilities of changes of state between two state machines) as taught in **Bahl** to include the matrix operations as taught by **Stolcke** since **Stolcke** teaches that his method to compute the matrix, R, speeds up the prediction and completion steps of determining the sums of probabilities of a matrix, thereby substantially reducing the computational cost of running the algorithm **(page 198, paragraph 4)**.

49. As to **Claim 4**, **Bahl** teaches: wherein the evaluation model comprises a hidden Markov model of the at least one evaluation phone and wherein the synthesizer model comprises a hidden Markov model of the at least one synthesizer phone **(column 3, lines 20-24)**.

50. As to **Claim 5**, **Bahl** teaches: wherein at least one of the hidden Markov models comprises a plurality of states and a plurality of transitions between states, wherein at least one of the transitions is a transition from one of the states to itself, wherein at least one of the transitions is a transition from one of the states to another of the states, wherein each transition has a transition probability associated with it, and wherein each state has a probability density associated with it **(Figure 2 and description, column 9, lines 21-24, lines 44-47,52-62)**.

51. As to **Claim 6**, **Bahl** teaches: wherein the plurality of states comprises a starting state, an ending state and an intermediate state, wherein the plurality of transitions comprise: a transition from the starting state to itself; a transition from the starting state to the intermediate state; a transition from the intermediate state to itself; a transition from the intermediate state to the ending state; and a transition from the ending state to itself **(Figure 2 and description)**.

52. As to **Claim 10**, **Bahl** teaches: wherein the step of determining a matrix from the evaluation and synthesizer models comprises the steps of: determining a plurality of product machine states **(Figure 13)**; and determining a plurality of product machine transitions between the product machine states **(column 4, lines 19-21)**.

53. As to **Claim 11**, **Bahl** teaches: the method of claim 10, wherein: each of the product machine states corresponds to one of the states of the evaluation model and one of the states of the synthesizer model **(Figure 13 and description)**; each of the product machine transitions connects one of the product machine states to the same or another product machine state **(column 4, lines 19-21)**; and a product machine transition exists when one or both of the following are true: a transition connects one evaluation model state with the same or another evaluation model state and a transition connects one synthesizer model state with the same or another synthesizer model state **(column 3, lines 60-65, column 4, lines 9-11** wherein F1 corresponds to the evaluation model and the F2 corresponds to the synthesizer model).

54. As to **Claim 12, Bahl** teaches: the method of claim 10, wherein the step of determining a matrix from the evaluation and synthesizer models further comprises the steps of: determining a product machine transition probability for each of the plurality of product machine transitions **(column 4, line 19-21)**; and determining a synthetic likelihood for each of the product machine states **(column 4, lines 21-22, column 14, lines 61-66)**.

55. As to **Claim 13, Bahl** teaches: wherein the matrix comprises a plurality of elements and wherein each element of the matrix corresponds to a potential transition between two of the product machine states **(column 4, line 13-20)**.

56. As to **Claim 14, Bahl** teaches: wherein the step of determining a matrix from the evaluation and synthesizer models further comprises the steps of: selecting an element of the matrix **(column 15, lines 1-6)**; assigning a probability to the element if a product machine transition exists between two product machine states corresponding to a potential transition that corresponds to the element **(column 14, lines 62-68, column 15, lines 1-13)**; and continuing the steps of selecting and assigning until each element of the matrix has been assigned **(column 14, lines 62-68, column 15, lines 14-15)**. As to assigning a zero to the element if there is no potential transition, it is known in the art to fill in the matrix with zeroes if there is no corresponding coefficient or element for that particular row and column in the matrix.

57. **Claims 20 and 38 are** rejected under 35 U.S.C. 103(a) as being unpatentable over **Bahl** as applied to claim 17 above, and further in view of Bahl et al (Bahl et al, "Constructing Groups of Acoustically Confusable Words", Acoustics, Speech, and Signal Processing, 1990. ICASSP-90, 1990, International Conference on, 3-6 April 1990, pages 85 - 88 vol.1), herein referred to as **Bahl'90**.

58. As to **Claims 20 and 38, Bahl** teaches determining synthetic likelihoods for each of the plurality of product machine states **(column 4, lines 21-22, column 14, lines 61-66).**

59. **Bahl** does not expressly teach wherein the synthetic likelihoods are compressed by ranking.

60. **Bahl'90** teaches synthetic likelihoods compressed by ranking **(page 86, column 2, paragraph 2, sentences 6-7, and item 2)** wherein the first 50 words are used to match values in a speech recognition system to create a short list of candidate words to match to input data thereby reducing the computation time of the matching algorithm in a speech recognition process and to be used in the evaluation of language models **(page 87, conclusion)**.

61. It would have been obvious to one of ordinary skill in the art at the time the invention was made to compress the synthetic likelihoods as taught by **Bahl** by ranking as taught by **Bahl'90** since the compression by ranking method is used to reduce computation time of the matching algorithm in a speech

recognition process as taught by **Bahl'90 (page 87, conclusion)**. Further, it is noted that both **Bahl** and **Bahl'90** teach the evaluation of language models in speech recognition systems.

62. **Claims 22,25,53 and 58** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Bahl** as applied to claim 17 above, and further in view of Jelinek (Jelinek, F., "Self-organized Language Modeling for Speech Recognition", Readings in Speech Recognition, page 474, 1990), herein referred to as **Jelinek**.

63. As to **Claims 22,25,53 and 58, Bahl** teaches: further comprising the steps of: f) performing steps (a) through (e) for a plurality of word pairs, each word pair comprising evaluation and synthesizer models, thereby determining a plurality of acoustic confusabilities **(Figure 3 and description, column 8, line 62-column 9, line 6).**

64. **Bahl** does not expressly teach: determining acoustic perplexity by using the plurality of acoustic confusabilities.

65. **Jelinek** teaches determining acoustic perplexity by using the plurality of acoustic confusabilities **(page 474, paragraph 5, "Perplexity is therefore..." – paragraph 6)**. Specifically, **Jelinek** teaches that models constructed on different principles will approximate P(w,...) in a different way and will lead to a lower perplexity if the model is better. **Jelinek** teaches determining acoustic perplexity using a plurality of acoustic confusabilities since the model can be constructed on different principles, therefore, a model can be constructed based on the acoustic confusabilities, thereby, approximating P(w,...) in a different way.

66. It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the acoustic confusabilities as taught in **Bahl** to determine the acoustic perplexity as taught in **Jelinek** since the use of the acoustic confusabilities to construct a different model will approximate P(w,...) in a different way, thereby leading to a lower perplexity where these perplexities are acoustic perplexities **(page 474, paragraph 5, "Perplexity is therefore..." – paragraph 6)**.

67. **Claim 40** is rejected under 35 U.S.C. 103(a) as being unpatentable over **Bahl** as applied to claim 1 above, in view of **Stolcke**, and further in view of Official Notice.

68. As to **Claim 40, Bahl** teaches: wherein step (a) further comprises the step of, for each acoustic confusability: determining a matrix from a corresponding product machine **(Figure 13)**; and wherein each hidden Markov model comprises a plurality of phones **(column 6, line 65-column 7, line 1, column 7, lines 31-40)**. As to wherein a larger word and a smaller word have an identical sequence of phones, wherein the larger of the two words comprises an additional set of phones, a segment of a larger word can

contain a smaller word, for example, the words "ballpark" and "ball", wherein the larger of the two words, "ballpark" will comprise an additional set of phones for the "park" segment of the word, and since both words contain "ball", the larger word and the smaller word would contain an identical sequence of phones for this portion of the word.

69. **Bahl** does not expressly teach: and determining an inverse of a second matrix created by subtracting the matrix from an identity matrix; and wherein a set of calculations performed when determining the inverse of the matrix for the smaller word is cached and used again when determining the inverse of the matrix for the larger word.

70. **Stolcke** teaches a matrix R as a matrix of the sum of probabilities for changes of state between two state machines **(page 178, item d and the last 3 paragraphs)** and an algorithm in which an inverse of a second matrix created by subtracting the matrix from an identity matrix **(pages 197-198, section B.3.1)**. **Stolcke** teaches this as a method to speed up the time it takes to compute the matrix R and perform matrix inversion, thereby reducing computational cost **(page 198, paragraph 4)**.

71. It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the determination of a matrix of acoustic confusabilites (probabilities of changes of state between two state machines) as taught in **Bahl** to include the matrix operations as taught by **Stolcke** since **Stolcke** teaches that his method to compute the matrix, R, speeds up the prediction and completion steps of determining the sums of probabilities of a matrix, thereby substantially reducing the computational cost of running the algorithm **(page 198, paragraph 4)**.

72. As to wherein a set of calculations performed when determining the inverse of the matrix for the smaller word is cached and used again when determining the inverse of the matrix for the larger word, **Bahl** teaches methods to reduce computational time of the probabilities and reduce the required storage **(column 8, lines 5-20)**. Official notice is hereby taken that if a smaller word makes up part of a larger word, it would have been obvious to one of ordinary skill in the art at the time the invention was made to store the smaller word to be used again for the larger word since it would significantly provide cost savings to the computational algorithm and reduce the amount of data storage required.

73. **Claims 41-45** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Bahl** as applied to claim 24 above, and further in view of **Gravier**.

74. As to **Claim 41**, **Bahl** teaches determining acoustic confusability for each of a plurality of word pairs **(Figure 13, column 4, lines 8-17)**.

75. **Bahl** does not expressly teach: wherein step (a) further comprises the steps of, for each of the word pairs: determining an edit distance between each word of the word pair; and determining acoustic confusability from the edit distance.

76. **Gravier** teaches determining an edit distance between each word of the word pair; and determining acoustic confusability from the edit distance **(page 563, paragraph 2, sentence 2, abstract, sentence 4)**. This determination of edit distance is used in a search procedure in a speech recognition system in order to speed up the search process of matching input data with entries in a database **(page 563, paragraph 2, sentences 3-5)** in which entries are retrieved whose edit distances fall below a pre-defined threshold.

77. It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the determination of acoustic confusabilities as taught in **Bahl** with determining an edit distance to determine the confusabilities as taught by **Gravier** since determining the edit distance is an alternative way to determine the confusability and the use of the edit distance can speed up the search of the database as taught by **Gravier**.

78. As to **Claim 42, Gravier** teaches: wherein the edit distance is determined by determining a number of operations and a type of each operation to change one word of the word pair into the other word of the word pair **(page 563, paragraph 2, sentence 2**, "determined as the number of...").

79. As to **Claim 43, Gravier** teaches: wherein the operations are selected from the group consisting essentially of deletions, substitutions and additions of phones **(page 563, paragraph 2, sentence 2)**.

80. As to **Claim 44, Gravier** teaches: further comprising the step of weighting each operation **(page 563, paragraph 2, sentence 4)**.

81. As to **Claim 45, Gravier** teaches: further comprising the step of assigning a cost to each operation **(page 563, paragraph 2, sentence 4)**.

Conclusion

82. The prior art made of record, see PTO 892, and not relied upon is considered pertinent to applicant's disclosure, careful consideration must be given prior to Applicant's response to this Office Action.

83. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Mary C Hogan whose telephone number is 571-272-3712. The examiner can normally be reached on 7:30AM-5PM Monday-Friday. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kevin Teska can be reached on 571-272-3716. The fax phone

number for the organization where this application or proceeding is assigned is 703-872-9306. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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